

MICROCLIMATE AND THE DESIGN OF AN URBAN SQUARE

by

WENDY ANNE LANDMAN

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Signature of Author
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Certified by
Thesis Supervisor
Accepted by
Chairman, Departmental Committee on Theses

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ABSTRACT

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Submitted to the Department of Urban Studies and Planning on May 9, 1975 in partial fulfillment of the requirements for the degree of Bachelor of Science.

One of the primary determinants of form in the design of outdoor spaces should be the microclimate and ecology of the place. Often a design for an urban space is formulated with only cursory attention given to these two aspects of the environment. This inattention to the underlying physical characteristics of a space has often resulted in the building of uncomfortable and unusable outdoor spaces.

The design of outdoor spaces is usually approached from the point of view of the activities the space is intended to house. This is of course a primary consideration, but when a space is designed with little regard for either the microclimate or the program, the chances for creating a successful place are greatly reduced.

This thesis consists of a discussion of how these two fundamental inputs can be joined and used in the design of a public square, and illustrates a design based on the discussion. A microclimatic analysis of an urban square has been undertaken, and the results of the research have been translated into design criteria. A design of the space according to programmatic and client needs was completed in the Environmental Design Studio, of which I was a member. This design was prompted by criteria which grew out of a user needs study and by group discussion of how the space should function. The two sets of criteria, microclimate and client needs, were dealt with separately in the first stage of the thesis.

The final portion of the thesis is a design for the revitalization of an urban square which incorporates both programmatic criteria and microclimate data. An explanation of the design solution as it relates to the sets of criteria accompanies the final design.

KITTREDGE PARK - A BRIEF HISTORY

Alvah Kittredge Park is a small (250 x 600 foot) urban square. It is formed on all sides by residential buildings at least two-and-a-half stories tall (with one gap where buildings have been removed) and forms a cohesive, contained space. The square is roughly oriented along a north-south axis, and an impressive view of Boston can be seen from the NE corner of the square.

Kittredge Park is located in the center of the Highland Park neighborhood, one of Roxbury's older, hilly sections. The topography of the area is varied, with John Eliot Square, site of the First Church of Roxbury, down the hill from the square, and Highland Fort Park, with its 130-foot water standpipe on a hill above the square. The Highland Park neighborhood is fairly well defined by both natural and man-made edges.



THE
HIGHLAND PARK
NEIGHBORHOOD



5

HIGH FORT PARK

CEDAR STREET

CENTER STREET

LANBERT STREET

KITTREDGE
PARK

HIGHLAND STREET

JOHN ELIOT SQUARE

← TO DUDLEY
STATION



1" = 400'

Kittredge Park and the area around it are the site of many interesting buildings.

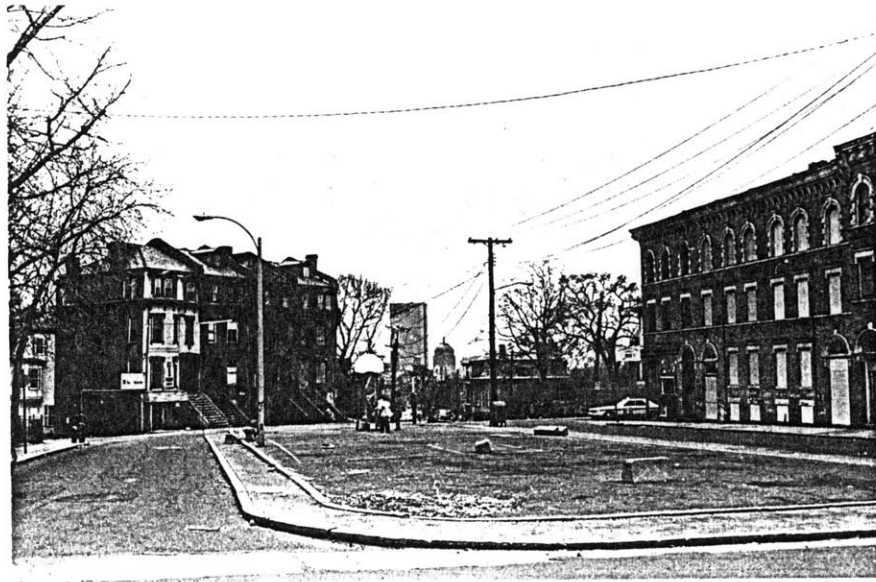
The following historical background of the place is excerpted from an Historic Preservation Statement written by the Boston Landmarks Commission in 1971.

In the seventeenth and eighteenth centuries, the Kittredge Square area was undeveloped agricultural upland. Centre Street existed as part of the road from Boston to Dedham and points south, but Highland Street and the various cross streets of the area were not laid out until the second quarter of the nineteenth century. In the summer of 1775, a fort was built at what is now Highland, Linwood and Cedar Streets; this was the Roxbury Lower Fort, a companion to the High Fort (now Highland Park) in the chain of defenses that helped bring about the evacuation of the British from Boston.

The beginnings of suburbanization in the area occurred when Highland Street was laid out in 1825. Other streets followed in succeeding years, until by 1860 the present-day street pattern was virtually complete. In 1835, Alvah Kittredge (after whom Kittredge Square was named) purchased several large parcels of land, one of which included both sides of Cedar Street from Centre Street to Washington Street. The following year he built his columned Greek Revival mansion (now 10 Linwood Street) on the old Lower Fort site. Kittredge was responsible for developing much of the area in the years from 1835 until he sold his mansion in 1866 (he died in 1876). The pattern of development during this period consisted of a gradual selling off of individual lots on which detached single or double houses were built, either by the original developer (such as Kittredge) or by a builder on speculation, or by the new owner for his own use.

The red brick townhouses around the park (1-3 and 5-8 Kittredge Park) were built in the early 1870's by developers and sold off as individual units. The cream colored brick tenements on the eastern and southern edges of the square were built at the turn of the century.

By about 1900, the Kittredge Square area had reached its maximum density. More recent years have brought a reduction in intensity of land use, as vacant or unmaintainable buildings have been demolished. Through this process, more vacant lots exist now than in the late nineteenth century. The reasons for this situation are tied up with the decline of the neighborhood as a desirable place to live, despite its architectural and environmental assets. The original farming community became suburbanized in the mid-nineteenth century, reaching its high point of development around 1870.



LOOKING NORTHEAST IN KITTREDGE SQUARE
WITH BOSTON IN THE DISTANCE



EARLY 20th
CENTURY HOUSING
ON EASTERN
SIDE OF THE
SQUARE

Since the extension of public transit out from this area and the advent of the automobile, commuting ranges have been greatly increased and the Kittredge Square area has been passed by, by those seeking high quality housing. Successively poorer groups of people have moved into the area as their predecessors moved away. 1975 finds Kittredge Square in a sad state of repair with most of its buildings uninhabited and in need of rehabilitation.

During the last few years some life has begun to flow back into the area. The offices of the Roxbury Action Program (RAP) are in the old Alvah Kittredge mansion, and RAP has been responsible for the rehabilitation of a group of row houses on Highland Avenue. RAP has found federal and state funding for building new housing and providing residents in the area with rehab money. They hope to turn the Highland Park neighborhood into a "model Black community" capable of providing housing, commercial facilities and economic opportunities for a mixed income, inner-city neighborhood.

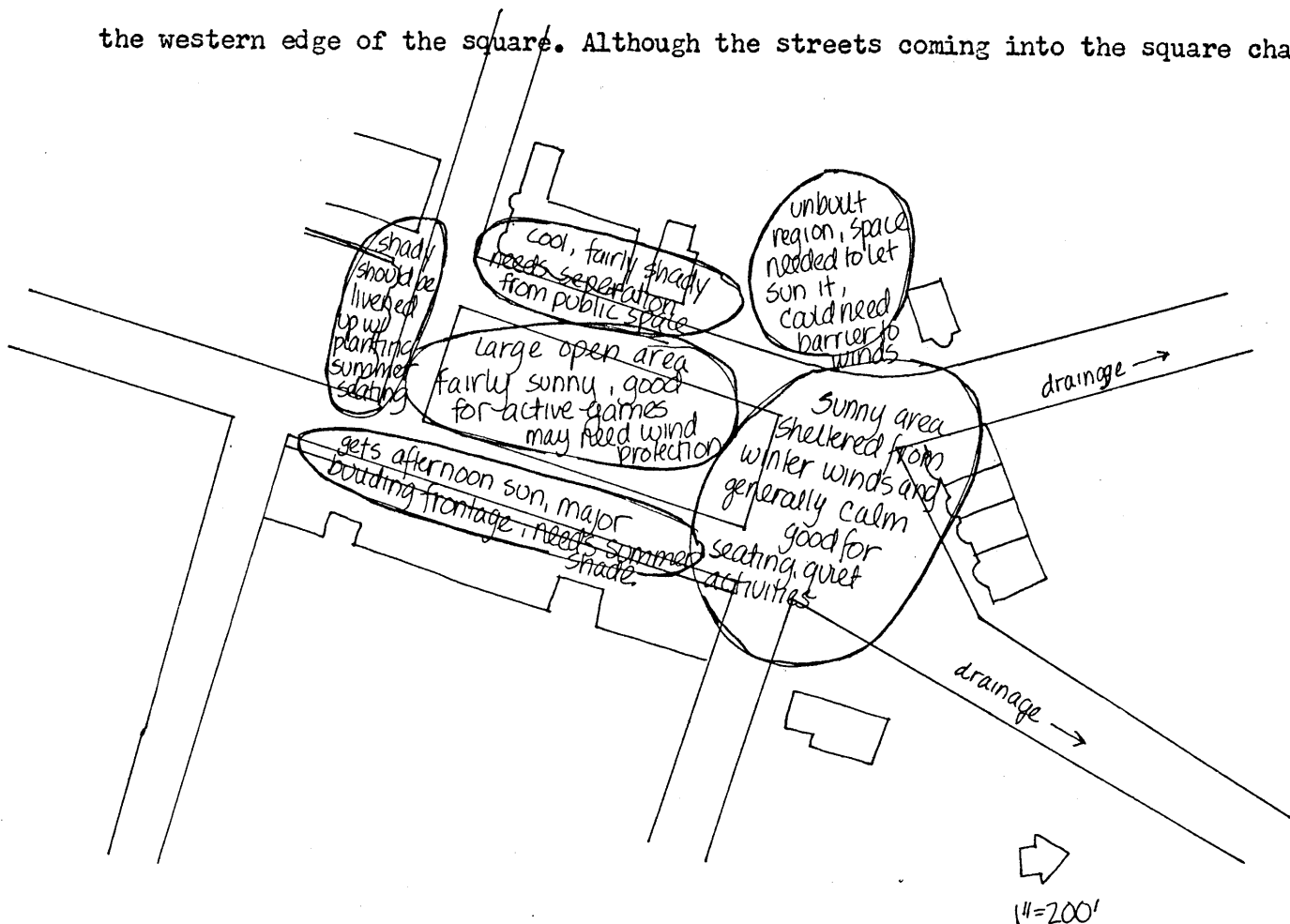
Although Kittredge Square does not currently provide a comfortable or cared for space in the community, its strategic location and few physical amenities have allowed the space to act as a rudimentary community meeting place. Most afternoons and weekends large groups of kids use the square for basketball, bike riding and talking. Older boys and men come to the square to talk and display their cars.

As a place which has already become a focus of activities, Kittredge Square seems an appropriate site for physical improvement, and the provision of community facilities. The square has the potential of being used by a wider range of people and for housing more and varied activities. The space could become a lively community center - used throughout the day and in all seasons and kinds of weather.

SUMMARY OF MICROCLIMATIC ANALYSIS

The microclimatic analysis of Kittredge Park included those aspects of the physical environment which have the most noticeable impact on human comfort; sun, wind, thermal conditions, precipitation, vegetation and textures of the place. The conditions were viewed in the context of turning Kittredge Park into a comfortable outdoor space, capable of handling a variety of activities.

Perhaps the most striking quality of Kittredge Park's microclimate is the fact that the square is laid out in a way which tends to use the natural environment to its advantage. The shorter buildings are on the southern end of the square - thus sun comes into much of the space. The winter winds, which come generally from the NW seem to be baffled by the buildings of Highland Avenue and the hill and trees behind the western edge of the square. Although the streets coming into the square channel



the wind to some degree, there do not seem to be any "wind tunnel" areas in the square. Summer winds may also be somewhat impeded by the building configuration.

Those areas of the square which receive the most sunlight also contain materials whose thermal properties allow them to absorb heat efficiently - thus creating some warm areas which have potential for being comfortable areas in cold weather. The buildings and streets give Kittredge Park a large thermal mass, and associated thermal lag, which tends to moderate the microclimate of the square. Once the buildings are inhabited again, the heat they radiate will probably make the square feel somewhat warmer than less built-up areas.

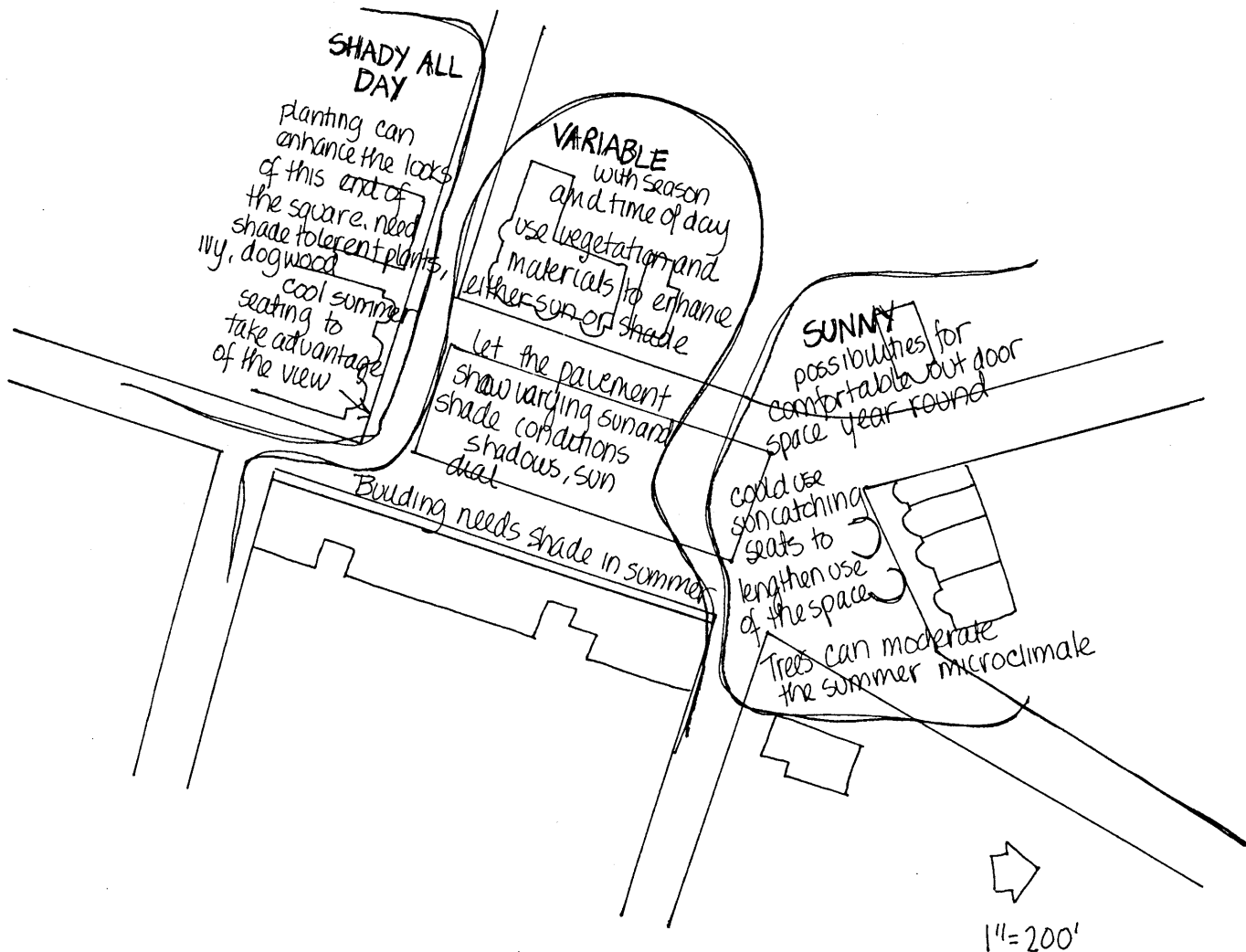
Precipitation in the square does not generally differ from that in the Boston area as a whole, and there do not seem to be any drainage problems. Presently, there are not any sheltered areas in the public portions of the square.

There is little vegetation in the square excepting a few tall trees in mediocre condition and some weeds breaking through the asphalt. The question of vegetation has been dealt with in terms of suitable plantings for the future.

SUN

The importance of sun to Kittredge Park's microclimate is made clear by the large difference in surface temperatures which are recorded in the sunny and shady parts of the square. In those areas which were shaded the temperature of the buildings and ground surface was approximately the same as the air temperature. The surfaces in those places which received a good deal of sun had temperatures substantially higher than the air temperature.

The quantities of sun which the square receives vary dramatically with the seasons, but year round the central portion of the square is sunny at noon. The sketch shows the most important variations in the square.



If Kittredge Park's outdoor space is to remain usable in colder weather the location of seating and vegetation should capitalize on the available sunshine. The built portions of any new outdoor furniture should be designed and placed to absorb the maximum amount of heat in the winter, and plantings and built form should be designed to provide wind breaks. Summer shading is an important consideration, currently very little exists. Deciduous planting appropriately arranged can take advantage of the differences in summer and winter shading caused by the trees.

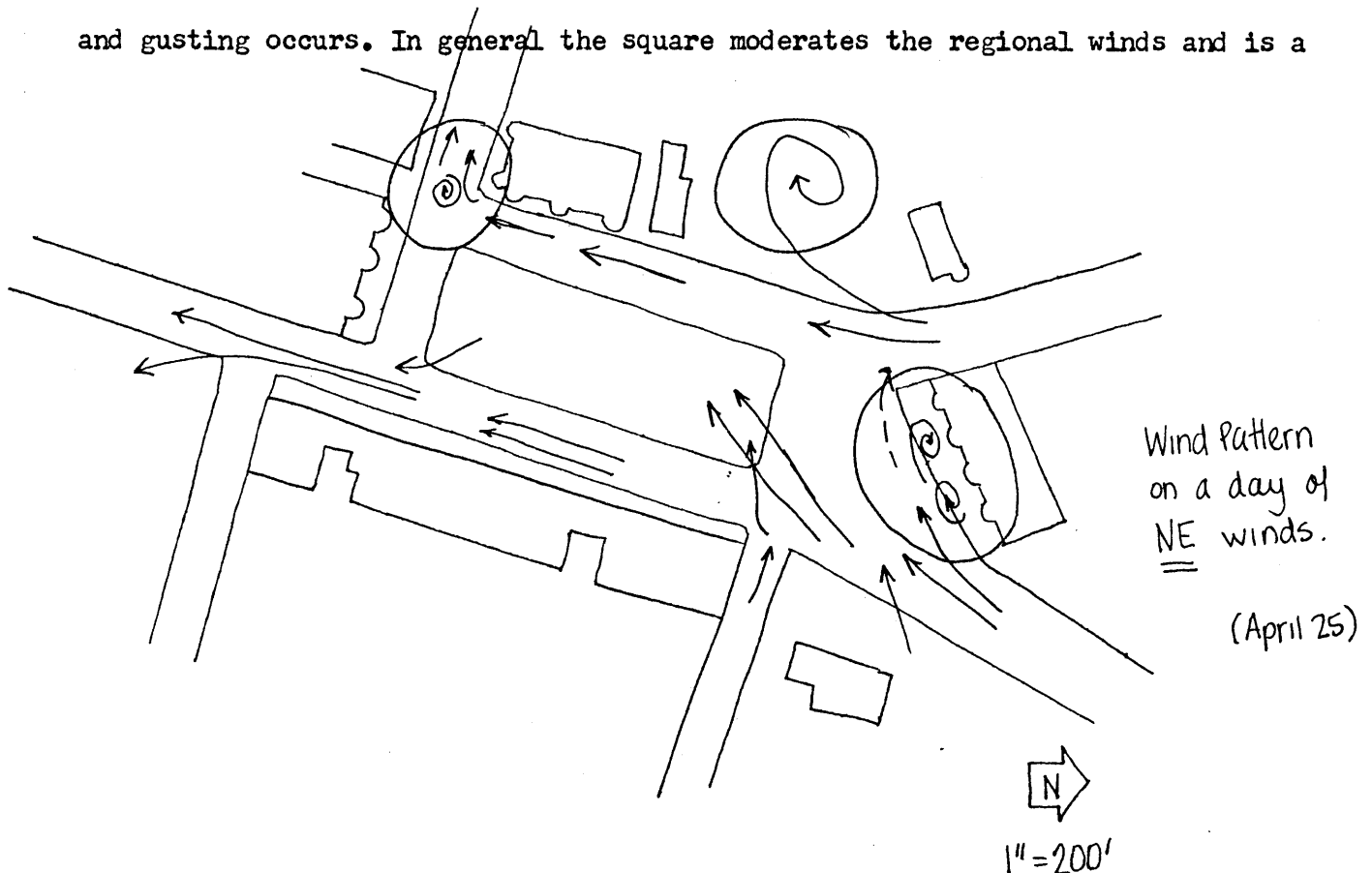
Kittredge Park's fortunate orientation with respect to the sun (shorter buildings to the south, orientation along a N-S axis) should be maintained and reinforced. New construction should be carefully considered with regard to the shade it might produce in the square.

WIND

The circulation of air in Kittredge Park was examined to determine how wind affects the microclimate of the square. The effect of building configuration on the regional wind flow, and on the creation of calm and/or windy areas in the square was looked at. The wind patterns were mapped by blowing soap bubbles and noting their paths through the square.

In general the wind in the square blows in the same direction as the regional wind flow. The buildings change the wind direction by bending the wind around themselves, but do not radically affect the wind flow. Eddies are formed in three places, where the configurations of buildings and trees slows the air down and counteracts the prevailing wind. The eddy spots are noted in the diagram below.

There do not seem to be any "wind tunnels" in the space where air flow is sped up and gusting occurs. In general the square moderates the regional winds and is a



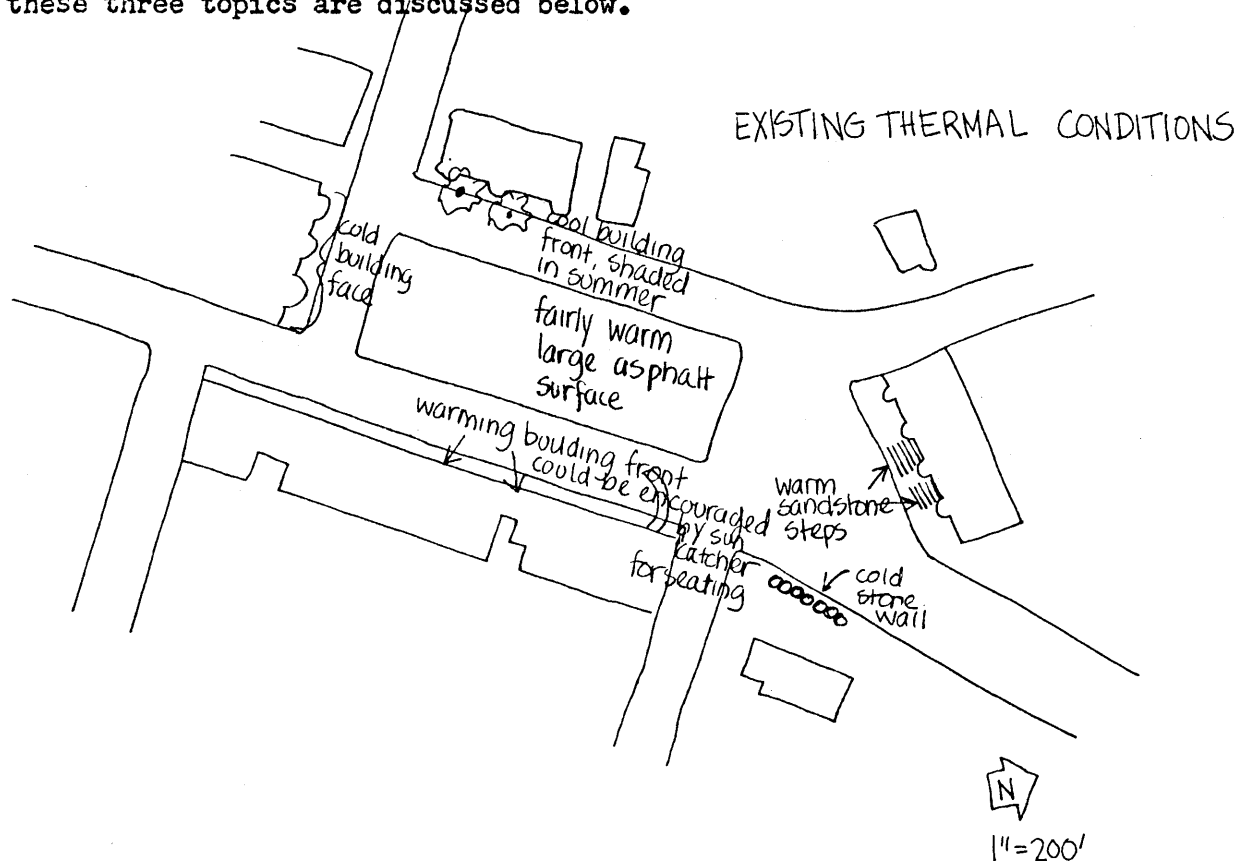
fairly calm space. Introducing properly placed vegetation can reinforce this pattern and both calm and windy spaces can be created. Design criteria dealing with wind are noted below.

1. places for sitting and talking which are sheltered from cold winds should be provided.
2. channeling of the wind should be avoided.
3. windbreaks made of vegetation are less obtrusive than those of built structures and should therefore be used wherever possible.
4. cold NW winds should be slowed down before they enter the square.
5. the eddy area at the northern end of Kittredge Park should be emphasized as an area for cold weather use because it is both sheltered from cold NW winds and is generally a calm area, and because it receives the maximum amount of sunshine in the square.
6. objects such as weeping willows, hanging banners or mobiles which take advantage of the wind should be used in the square.

THERMAL PROPERTIES OF MATERIALS AND STRUCTURES

The varying thermal properties, mass and angle of the built forms in Kittredge Park are the critical factors which, in conjunction with the amount of sunlight received, are the causes of the differences in the surface temperatures noted in the diagram. The sandstone steps at the northern end of the square were markedly warmer than the bricks in the same area, and the asphalt lies somewhere between the two in temperature. The end of the square with a southern exposure was by far the warmest area because of its longer exposure to the sun.

In designing the square to maximize comfort for its users several aspects of the choice of materials and building configurations should be kept in mind. These include; thermal properties of the material, mass of the form, and the angle of the structure with respect to the sun's rays. Design criteria and information concerning these three topics are discussed below.



Thermal Properties of the Material

Porous materials such as sandstone and asphalt are more rapidly heated by the sun than are denser materials such as brick or granite. The rate of conductance and specific heat of materials is crucial to their behavior with regard to the re-radiation of the sun's heat, these properties prompt the following design criteria:

1. materials of low thermal capacity (heat up and cool down relatively rapidly) should be used in areas designed for cold weather, and for "contact" places such as seating.
2. materials of high conductivity (metals) should not be used where extremes of temperature might occur.
3. materials of high thermal capacity (heat up slowly and retain the heat for a lengthy period of time) can be used as a back up thermal sink, both for warmth in the winter and coolness in the summer.
4. materials of low conductivity (wood, earth) should be used in areas which might become uncomfortably cold or hot and are to be touched.

A table containing the thermal properties of some common materials used in outdoor construction follows in the appendix.

Mass of the Form

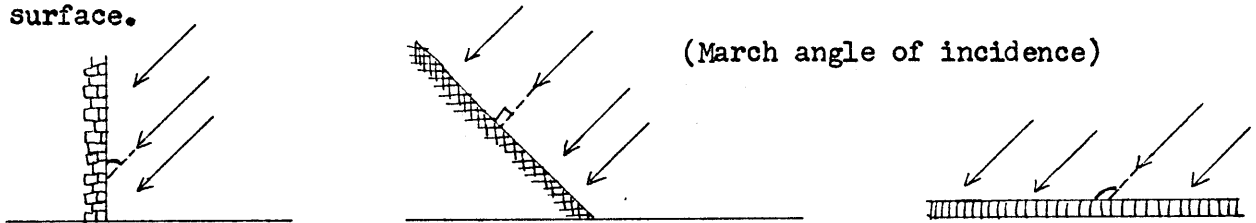
The mass of a particular object has a pronounced effect on its radiative qualities. The warmest surface temperatures recorded in the square were those of some steps. The steps have a relatively small mass (in addition to being made of sandstone) and therefore are able to absorb the heat and warm up rapidly. If there is a large mass/surface-area ratio a great deal of radiation must be absorbed through the surface before the body's temperature will rise above the air temperature. The importance of mass to thermal characteristics indicates another set of design criteria:

1. objects with a small mass should be used where rapid response to radiation is required (daytime seating in winter, summer evening spots).

2. where maintenance of a constant radiation background is desired a large mass (thermal sink) should be used. (the square as a whole, an outdoor shelter)

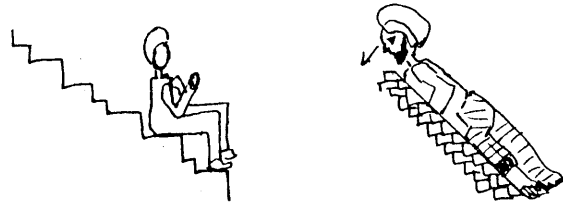
Angle of the Structure

The angle of a built surface relative to the sun is significant to its effectiveness as an absorber of the sun's rays. The steps noted above approach a 45° angle to the ground and thus receive the sun's radiation closer to the perpendicular than either the horizontal plane of the street or the vertical walls of the buildings. A maximum amount of radiation is absorbed when the incoming rays are normal to the surface.

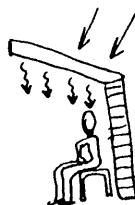


For this reason the angle at which seating or shelter forms are built is important to their effectiveness as absorbers of heat.

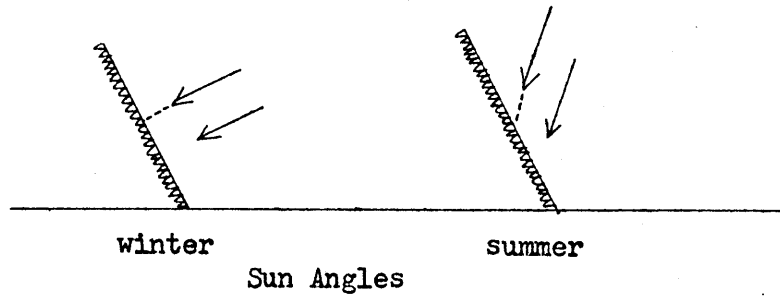
1. seating or walls to lean on which are supposed to be warm, should receive radiation at a 90° angle.



2. structures intended to act as thermal absorbers should take maximum advantage of the use of angled roofs and walls.



3. differences in the summer and winter sun angles can be used to advantage; a surface which is warmed in the winter may remain relatively cool in the summer.

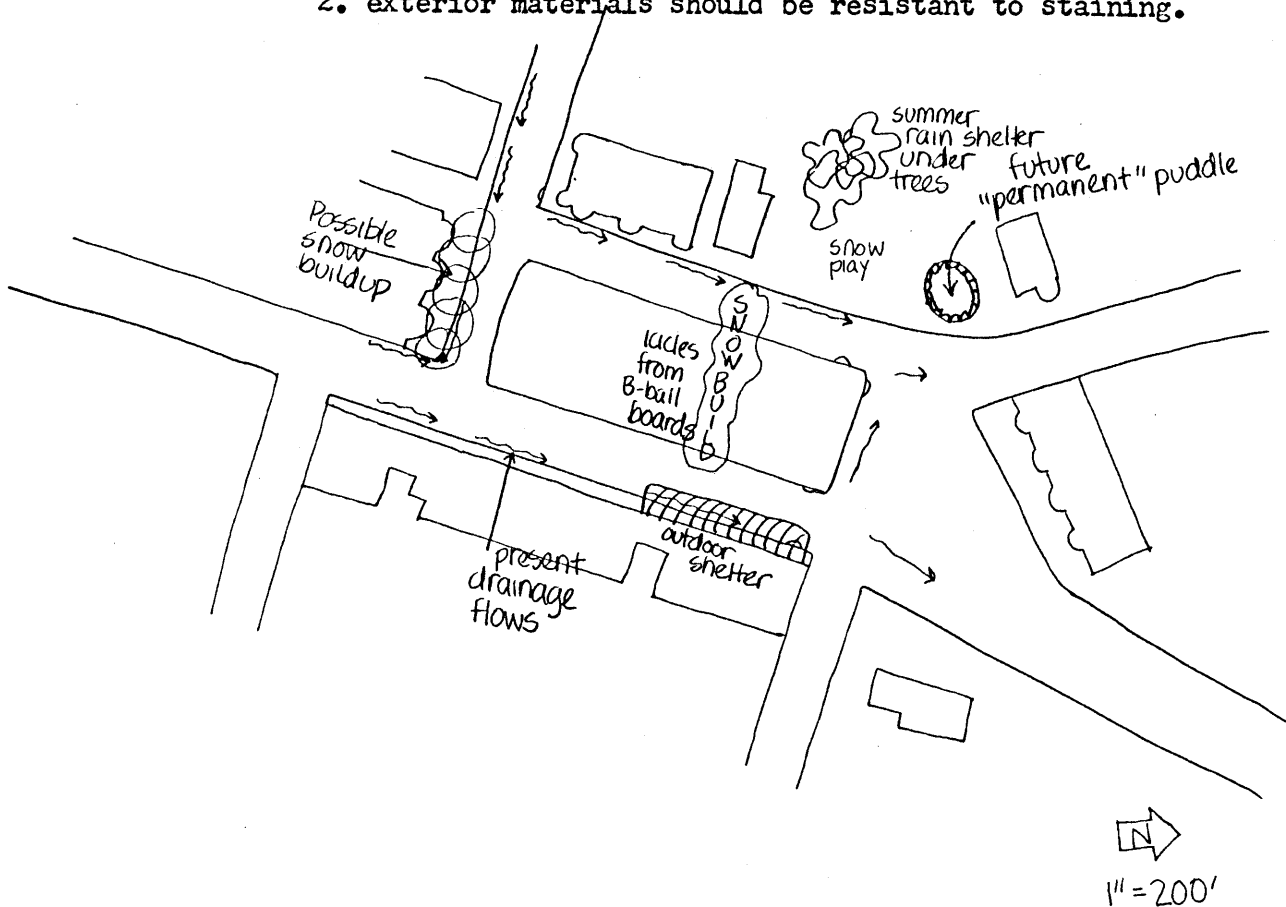


PRECIPITATION

Water runoff in Kittredge Park appears to function smoothly. When the square was observed during a severe rainstorm, after several hours of constant rain, no pockets of standing water were observed. The storm sewer inlets seem to be adequate and there were no places where water flow impeded either walking or driving.

Boston receives an average of about 43 inches of rain annually. The rainfall is uniformly distributed throughout the year, but there is considerable variation from year to year, with late Spring and Fall tending to have less than Summer and Winter. The slow evaporation in winter causes sustained periods of mud and slush. During approximately two weeks of Winter (daytime) icing of paved areas is problematical. Design criteria related to rain and water follow:

1. absorbant surface materials should be avoided in exposed areas.
2. exterior materials should be resistant to staining.



3. rain shelter should be provided in public outdoor spaces, both built and tree shelter can be used.

4. adequate runoff conditions should be provided to prevent puddles and discourage icing of roads and sidewalks. the use of water permeable paving and on-sidewalk drains should be considered.

5. the design of rain spouts and gutters should prevent dripping on pedestrian ways, and should discourage the formation of icicles where it could be detrimental to safety or building conditions.

6. rain, water and ice should be treated as interesting parts of the environment of the square and places for watching and playing in-and-with them should be provided. ("permanent" puddles, places where icicles can form, sheltered places to sit in the rain)

The average snowfall for Boston is about 43 inches, but the year to year variation is considerable. The maximum snow load on buildings is not likely to exceed 25-30 pounds (even in extreme conditions the load averages about 10 lbs). In January and February snow tends to accumulate between storms.

Existing data would seem to indicate that the square might experience a buildup of snow at the southern end of the square, both prevailing winds and exposure point to this area as problematic. The northern end of the square, with its sunny microclimate will probably be cleared of snow first, and drainage at that end of the square should take advantage of its early clearing. Design criteria regarding snow follow.

1. accumulations of snow in walking and driving areas should be avoided, provisions for the draining of melting snow are necessary (see #4 above).

2. provisions for piling of snow during periods of heavy accumulation should be provided (snow dumps out of the way of traffic and people).

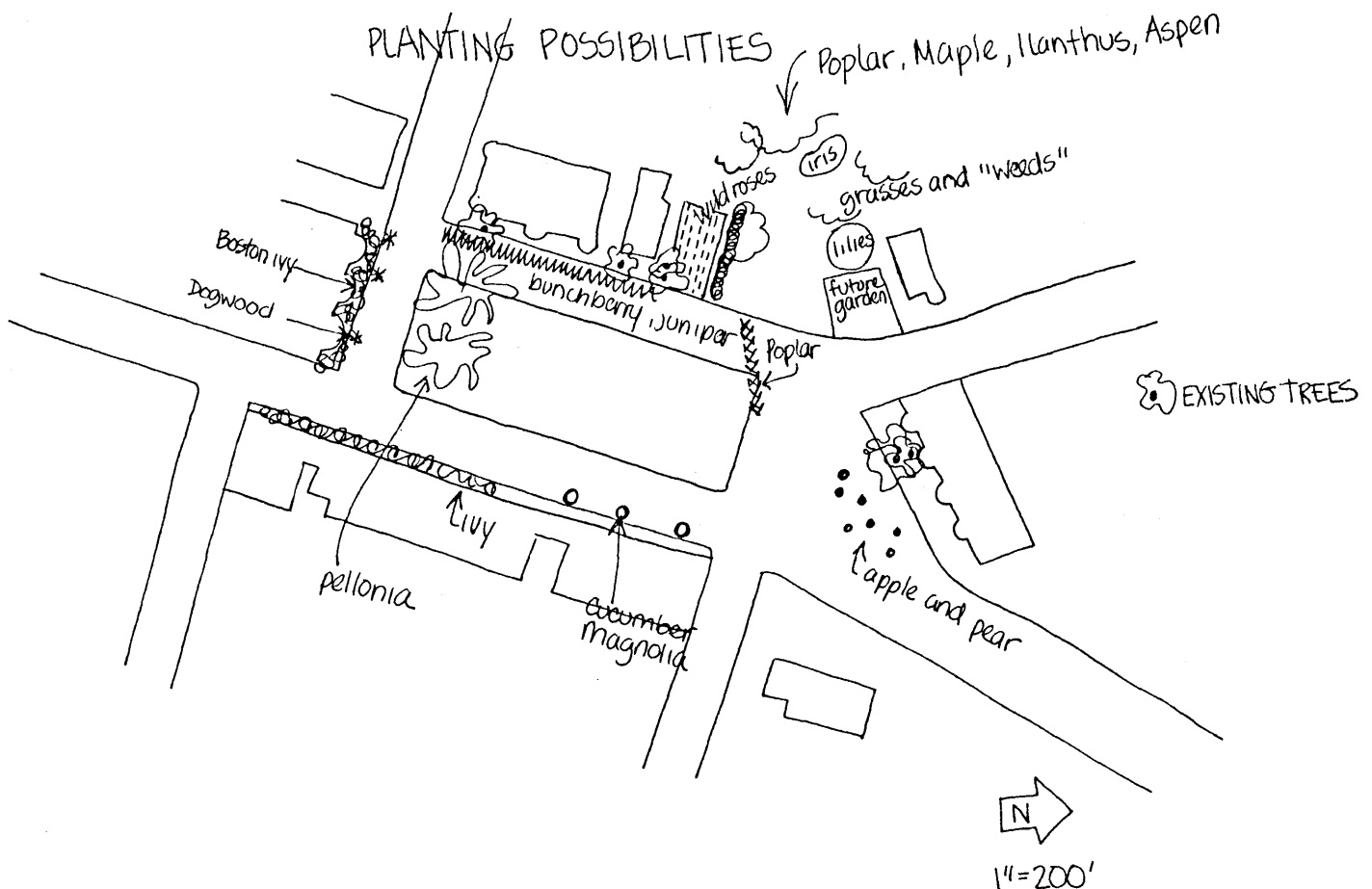
3. places for the enjoyment of snow, particularly where the snow will stay clean should be provided in the square.

VEGETATION

Kittredge Park currently contains a sad collection of vegetation. The trees need pruning and the ground level plants are trampled and uncared for. This characterization is true of all of the square except the area belonging to the people who live in the single family house on the western side of the square. Adjacent to their house is a neatly fenced and hoed garden plot which is evidently a source of both food and pride.

The dichotomy of cared for private spaces and disheveled public spaces is evident in many cities. It is a condition which seems to be ignored by many designers who continue to make the old mistakes. Three approaches to the problem seem possible:

1. to design spaces which need little maintenance and plant vegetation well adapted to the urban climate ;
2. strengthen the ties people feel for public spaces by



either treating them as private spaces which people can "claim" and therefore care for, or by making public spaces so attractive and populated that the people using them will treat them well ; 3. increase the degree of public maintenance in public spaces.

In formulating design criteria and recommendations for Kittredge Park an approach which includes all three tactics seems reasonable. Although the space is rather small different parts of it seem to warrant different treatment, this is reflected in the criteria noted below.

1. allow spaces directly adjacent to first-floor dwellings to be claimed by the residents, particularly in front of the townhouses on the western and northern edges of the square, level changes or dense greenery can encourage this.

2. encourage the use of urban-acclimated plants which do not require extensive care and will thrive in the city. (see the following pages)

3. assign responsibility for maintenance to community groups whose offices are in the neighborhood to encourage conscientiousness.

4. use plantings which change with the seasons, produce fruit and flowers, smell good, and generally enhance the physical environment of the square.

5. provide trees which can be climbed, both in open areas and in conjunction with built forms.



6. be careful with the use of shade trees to allow a variety of summer climates, ranging from sunny to densely shaded. Use shade trees and other plantings to improve the interior climates of the buildings.

7. use vegetation to provide wind breaks, and to increase the evaporative cooling of the square.

Although cities are often considered to be hostile to plants, there are many types of vegetation which flourish in cities. The mistake in urban planting comes when the special conditions of the city are ignored and unsuitable plants are introduced which then do not thrive. In addition to choosing plants which can grow in the city, the higher temperature which the city produces can allow the planting of species which usually thrive only in more southerly climates. The following list of well adapted urban plants comes chiefly from discussions with Terry Schnadelbach and from observations of urban vegetation. (The plants listed here have been chosen specifically for the Boston area.)

Ground Covers

grasses/weeds - timothy, foxtail, wild carrots

vines - virginia creeper

climbing vines - boston and english ivy (boston grows well in shade),
clematis

low shrubs - bunchberry, cape cod juniper (1-1½ ft. tall)

shrubs - wild roses, mock orange (Philadelphus), sumac, forsythia

flowers - iris, lilies, geraniums, crocus, daffodils, sunflowers

Trees

Apple - fruit bearing, needs sun

Aspen - white bark

Celtis Oxydentalis - has a chronic disease growth of witch hazel
(called witches broom), doesn't live very long
(30-40 yrs.), a sturdy urban tree

Cucumber Magnolia - needs sun, has a deep root which will not disrupt
foundations and sidewalks

Dogwood - early flowers, grows well in shady areas

Elm - beautiful large trees, dappled shade, must chose a dutch elm disease
resistant tree

Ilanthus - ubiquitous urban tree, grows fast and well, has a tap root
so won't disturb foundations, looks stick-like in winter

Locust - grows everywhere in cities, doesn't get very big and is not
very beautiful

Pear - fruit bearing, needs sun

Pellonia - Japanese Empress Tree, has large purple flowers, grows fast
and is a massive tree (whorled roots)

Striped Maple - grows well in medium shade

White Poplar - grows very fast, good wind break

Weeping Willow - gets to be very large, good for climbing, needs wet soil

Zel Kova - can be used as a substitute for an elm, a tough tree, grows slowly and is a good shade tree

Urban Foodstuffs

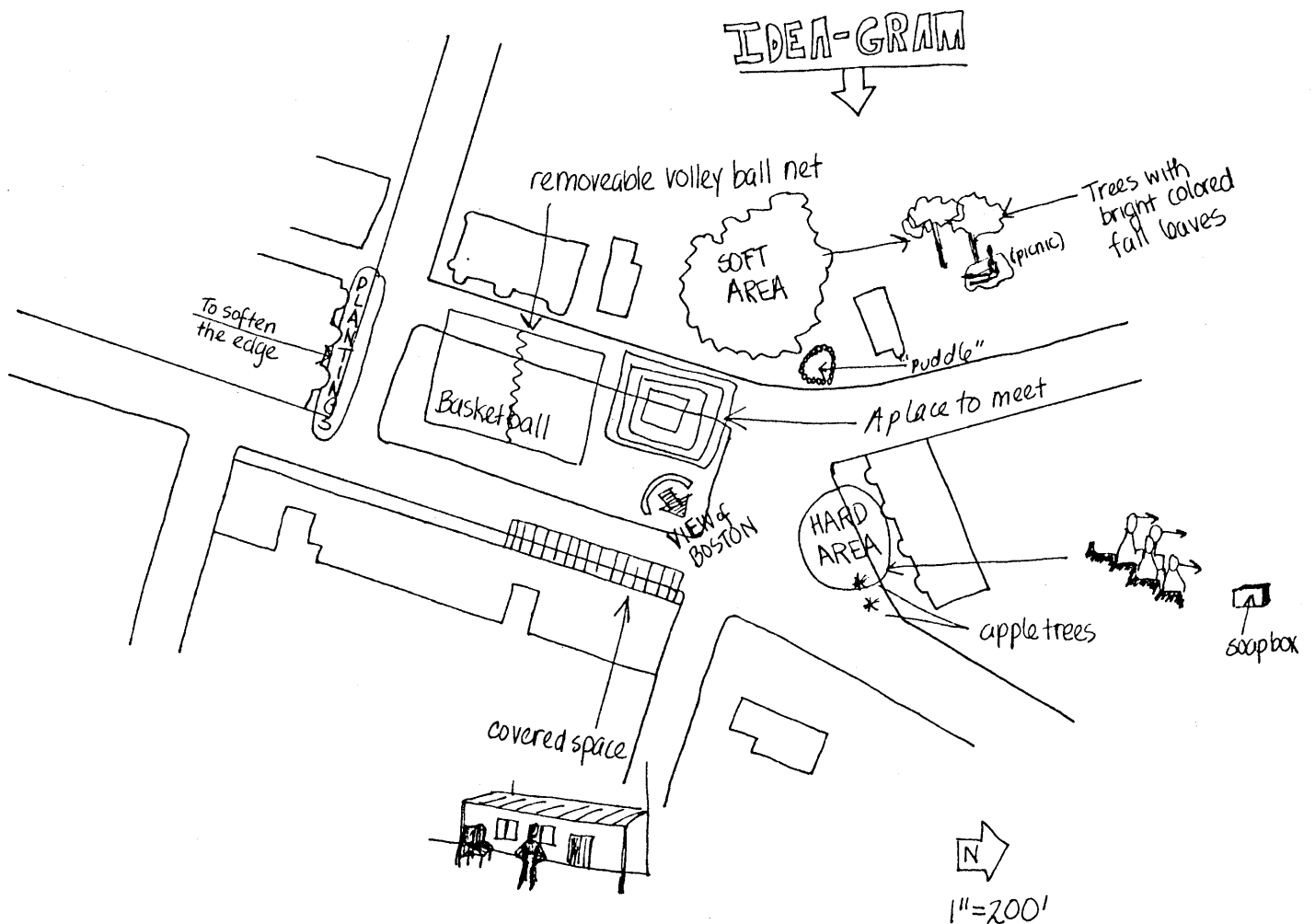
poke, collard greens, swiss chard, turnip greens, blackberries (bush)
pumpkins, squashes, watermellons (like sandy soil)

In addition to growing well in the city, the plants listed above (other than the foodstuffs) re-seed themselves. This means that once an area has been planted, barring a major die-off, the plants will produce progeny and a stand of vegetation will be permanent.

SENSUAL CHARACTERISTICS

The influences of texture, appearance and malleability of the materials in a space on the comfort and usability of that environment are substantial. These sensual characteristics are composed of a variety of qualities; the thermal characteristics of the materials, the textures (hard --> soft), the visual impact, the ways in which the materials weather and wear with use, and the variability of the materials with respect to time of day and season.

Providing the users of a space with a variety of sensual choices in view and surroundings can make a small space feel larger, and make a public space seem more personal. At the least, comfortable seating and meeting places and visually pleasing

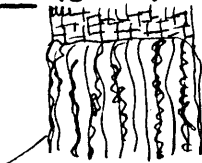


sights should exist year-round. Some design criteria which grow out of these needs for sensual enjoyment and physical comfort are listed below.

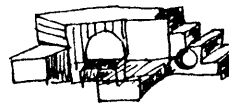
1. seating of both "neutral" (wood, earth) and "actively changing" (brick, stone) materials should be provided.

2. both protected and open areas for congregating available in the square

3. "soft" (green, watery) and "hard" (built, more formal) places should exist.



WATER
WALL of
PALEY
PARK



4. vegetation which changes with season should be planted, particularly things which are colorful (maples, suma, pellonia), flower (dogwood, forsythia), and produce things to eat (apples, berries, pumpkins).

5. built forms which change over time should be included. for example; sandstone steps which wear down, arbors over which vines can grow, moveable objects like volleyball nets.

6. there should be places to see out of like towers or windows, and places to look in to like soap box corners and basketball courts.

7. use forms which take advantage of: sun and shadow (sundials, sculptures), rain (puddle basins), cold (places where icicles form), wind (mobiles, weeping willows) and all the other changes in nature.

The list of ways in which the designer should think about and enhance the sensual environment could certainly continue, but those things noted above seem to be ones which are feasible and are appropriate to the scale of Kittredge Park.

A PROGRAMATIC DESIGN OF KITTREDGE PARK

The issue of redesigning Kittredge Park was first dealt with as part of a group project in the Environmental Design Studio. The design criteria which emerged in the group resulted from joint interpretations of client needs and programatic considerations. In looking at the Highland Park neighborhood as a whole Kittredge Park seemed to be, in both physical form and location, the focal point of the community. Its current use as a gathering place for people living in its immediate vicinity reinforced this image. For those reasons Kittredge Park was designed as a community center, with the physical and social attributes which that function demands.

The indoor services which the square was designated to house include the offices of the Roxbury Action Program (RAP), a day-care center (drop-in facilities), a convenience food store, a laundromat and dry-cleaners (existing), some community space, a branch library, some low intensity business space, and housing for both elderly and young people. The outdoor spaces of the square were intended to act as places for people to gather for talking, basketball, car-watching, people-watching and generally observing the neighborhood activities.

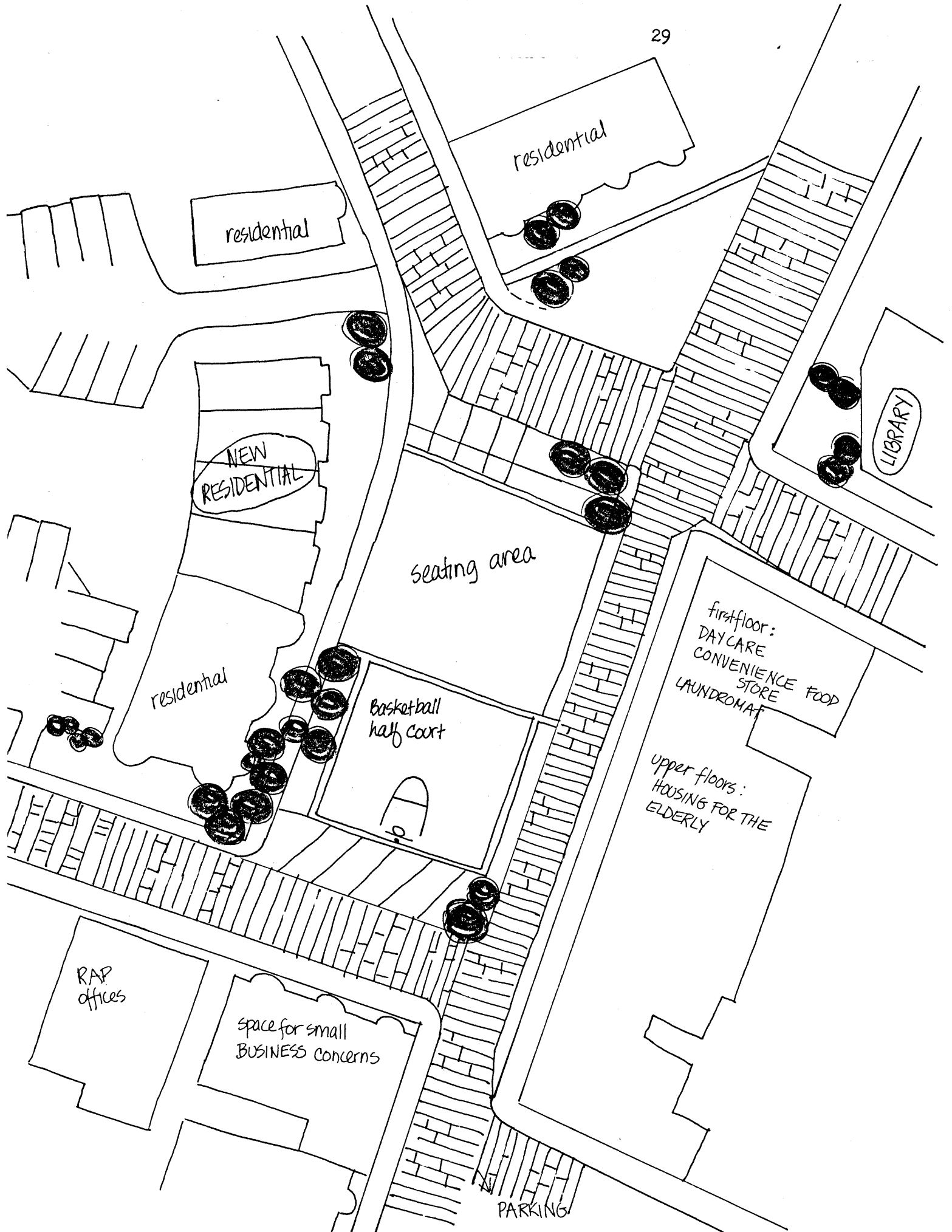
The basic criteria which the group decided should underly the design of Kittredge Park, and its physical form are as follows:

- 1.do not change the existing fine-grained pattern of development.
- 2.improve the walkability of the whole neighborhood, and make Kittredge Park a pedestrian oriented and physically unified space.
- 3.allow traffic to come through the square but let the cars know that pedestrians are the square's primary occupants.
- 4.make the square "softer", both visually and tactually.

These four criteria led the designer to the following physical solutions:

1. fill in the gap in the square's edge with a continuation of the townhouses on the western side of the square. (small single family house to be taken out)
2. move the square over and leave only one lane for traffic.
3. widen the sidewalks.
4. change the paving of the square; the pavement change occurs at the perimeter of the square and is the same for both auto and pedestrian areas - this is to indicate that although cars are allowed in, the square is a pedestrian place.
5. provide some parking (diagonal) in the square.
6. put a basketball half-court in the square (a few feet lower than street level to separate it from other activities and residences).
7. provide seating in the square.
8. Plant at the corners and edges of the square to soften its boundaries.

The new plan of the square is shown in the diagram on the following page.



GENERAL MICROCLIMATIC DESIGN CRITERIA

During the design stages which led to the physical changes discussed in the preceding pages chief consideration was given to the activities which would occur in the square. Slight consideration was given to the visual image of the square - most of the decisions which affect this grew out of the desire to fulfill the criteria of making the space a unified place. The issues of microclimate were not considered in any but the most perfunctory manner.

The information which emerged from a microclimatic analysis of the space resulted in a very different set of design criteria dealing almost exclusively with comfort in, and enjoyment of, the outdoor spaces. In general the criteria are ones which could be applied to many urban spaces, and are not particularly oriented to any specific client group or neighborhood. In the following paragraphs a set of crucial design issues are outlined.

A reexamination of the design criteria generated by microclimatic considerations reveals a relatively small group of generally important recommendations concerning the physical environment of a space. The detailed criteria discussed will be used in the design solution, but it was felt that a select group of ideas could summarize the outlook of designing with climate in mind. If the following issues are kept in mind and dealt with successfully in design, a reasonable microclimate and a usable space will hopefully result.

1. Human thermal comfort is dependent on the relative condition of four climatic factors; temperature, air speed, radiation and humidity. Air speed and radiation are the two factors most readily influenced by local physical cond-

itions. (see Olgyay, Design with Climate)

2. Different people are comfortable in different climatic conditions, therefore a range of "environments" should be provided in a space.

3. Outdoor places should be usable and maximally comfortable (as far as possible) both day and night, and year-round.

4. The appeal of an outdoor space is enhanced by capitalizing on the variety which weather and seasonal changes bring to a place.

These four issues are impacted by the specific microclimate factors discussed earlier in the paper, and the specific design criteria , if followed, will lead to design solutions which are cognizant of these four issues. When working on the design of a particular place it is often easier to work from specific criteria than from general issues, for this reason these issues were not brought up in an introduction to the paper , but as part of the overall exploration of the design process.

FINAL DESIGN

The design solution which grew out of the combined inputs of client needs studies, programmatic considerations and microclimate criteria is illustrated in the following pages. In working towards this solution certain physical design elements emerged as dominant motifs. At the most basic level these elements are:

1. create separate "rooms" in the square which can be used simultaneously by different individuals and groups of people.
2. visually frame the square itself, and the rooms within the square; to both unify the whole and to create varying environments within.
3. provide distinct pedestrian paths in and through the square.
4. minimize the impingement of the car on the pedestrian.

In addition to these physical motifs the overall wish to create a comfortable microclimate was a governing force in the design. The community services provided in the square are those which were determined in the original design solution which emerged in the Environmental Design Studio.

The specific ways in which these motifs were carried out are as follows. The square was first looked at as a whole, and the scheme which frames and defines the square is primarily composed of a unified paving system (sandstone-like substance, the specific material would have to be more weather resistant and durable) and a framing of the square with trees. The gaps in the built edges of the square have been closed with a library, which comes out into the square, and new housing whose form is intended to provide a visual gateway into the space.

The next level of design was the selection of the different rooms. Two areas emerged as major focal points. The first centers around the northeast corner of the square. This area will function as an informal gathering, sitting and talking place. The space is framed by an awning system. Within this room three separate environments have been created; a sheltered space adjacent to the facilities on the first floor of the large building (outside the day care and laundromat), a relatively active green space sunken in the central area, and a quiet green space raised above the street level on the NW corner of the intersection. This room is the sunniest portion of the square and within it are provided sunny, wind-sheltered seats, and the most protected environments. Deciduous trees have been included to shade both the outdoor spaces and the buildings in the summer.

The second major room is at the southern end of the square and consists chiefly of a sunken basketball (half) court with seating around it. Trees frame this room, and as the most active part of the space, its edges have been treated as buffers between quieter areas.

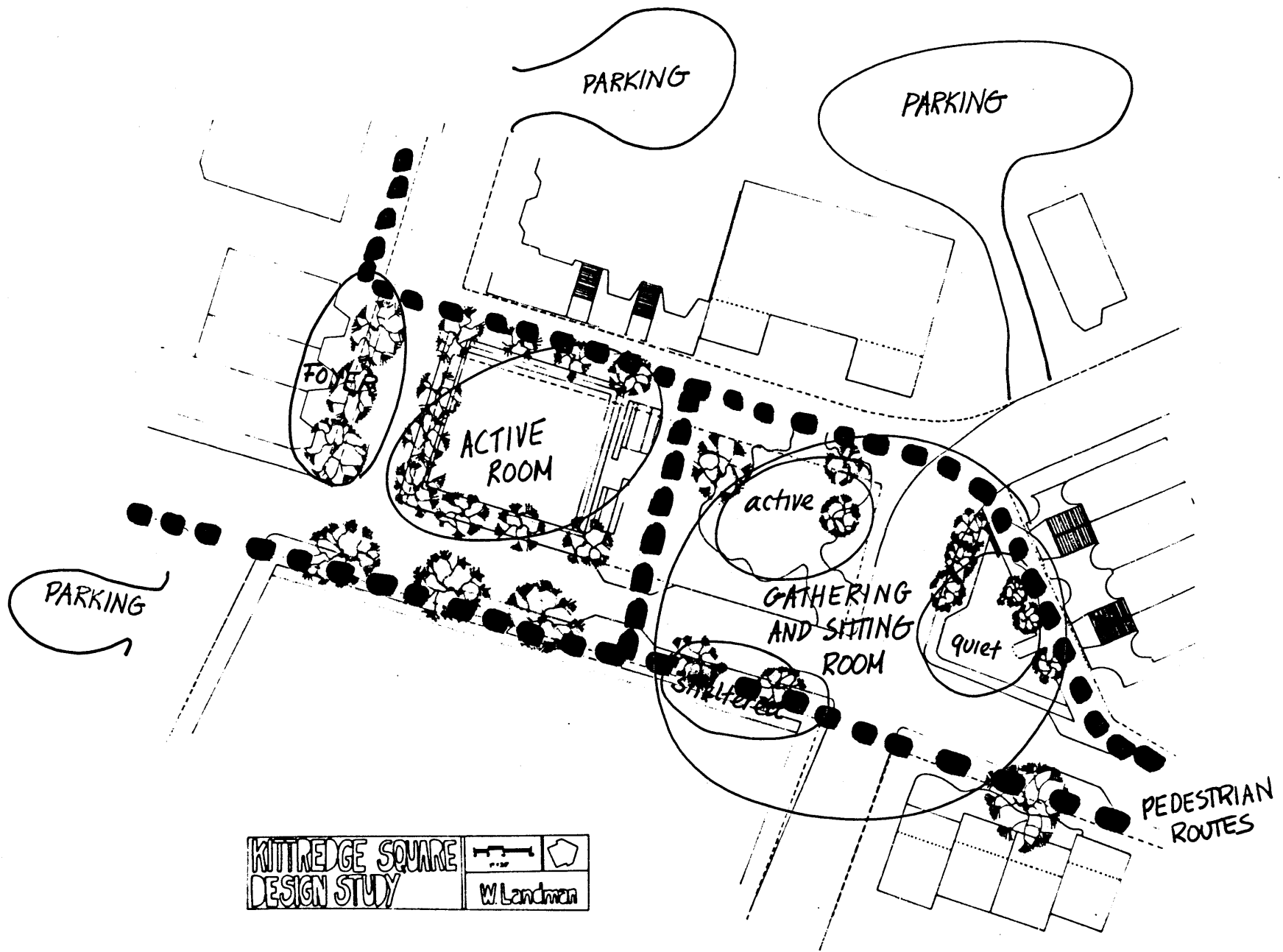
A minor third room is located in front of the building designated for small business offices. This room is intended to act chiefly as an informal outdoor foyer to the building, and is not seen as the site of many community activities. The treatment of this room is somewhat more formal than that of the other rooms.

The paths through the square have been defined in a variety of ways, by walls, trees, awnings and hedges. In each case as a path goes through a room its

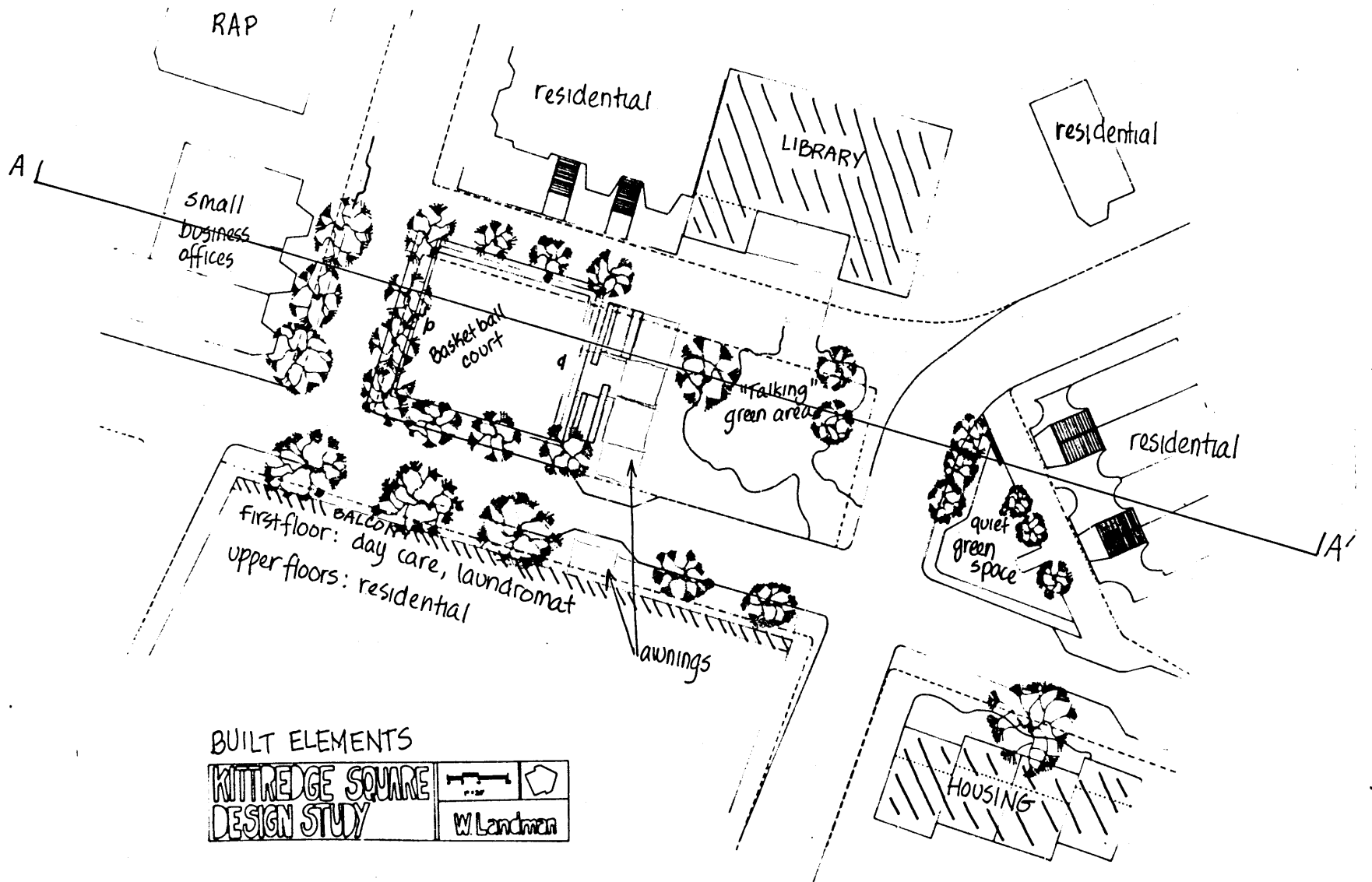
treatment is consistent with the room's activities and allows the passerby the freedom to either enter the space or remain at its perimeter.

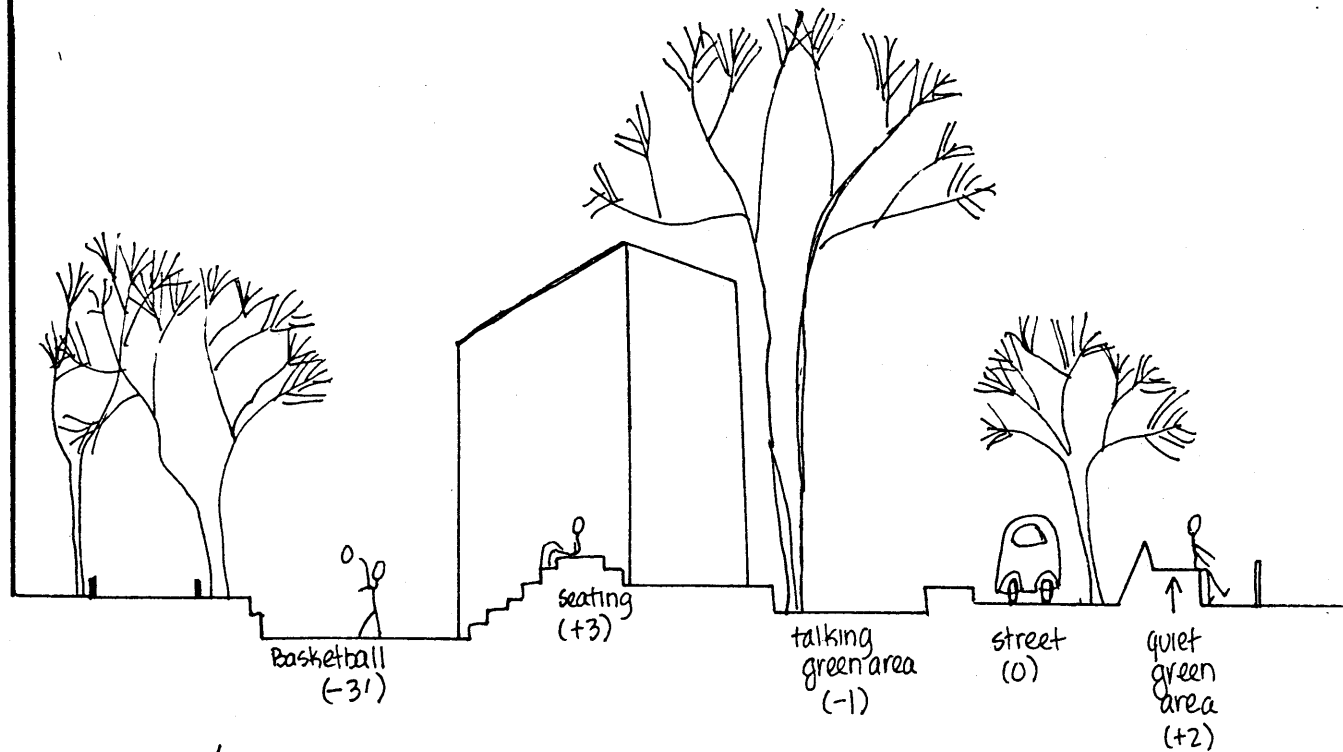
Cars in the square have been controlled by reducing the area in which they are permitted and slowing their speed by periodically narrowing the road.

There are no formal parking spaces provided in the square, but there is enough room for cars to pull over and stop.



KITTREDGE SQUARE DESIGN STUDY		
	W. Landman	





SECTION AA'
EXAGGERATED VERTICALLY

differences in elevation are used
chiefly to separate different activity
zones and allow a variety of
uses in a small space

DISCUSSION OF THE FINAL DESIGN PROCESS

The intention of this thesis has been to explore the design criteria generated by a microclimatic examination of a space and come to understand how these criteria can play a role in the design of an outdoor space. The issue of what role the criteria will play is important because the context in which the design occurs necessarily includes factors other than those dealing with the physical environment. Social, economic and functional inputs must all be considered.

The underlying data used in the formation of a design program for Kittredge Square included both the programmatic and client related issues which the Environmental Design Studio was concerned with, and the microclimate criteria which this paper discusses. Some explanation of how these two sets of data were used to arrive at the final design is in order.

As the description and drawings of the design solution clearly illustrate, the specific microclimate criteria are not wholly fulfilled, nor are the programmatic wishes carried out completely. The original sets of criteria have acted as guidelines rather than as rules and having specific criteria to work from increased the range of design possibilities because different criteria led to different tentative solutions. The solution which resulted from having a substantial amount of pre-design input is one which attempts to maximize both the social and physical usability of the square.

A few parts of the design raised some conflicts between microclimate and

programatic issues. The two most important of these are noted below.

One major design question was that dealing with the open space on the western edge of the square. The microclimate criteria generally led to a solution which left this area open, and had it serving as a mini-park where weather and plants could be explored. The programatic criteria led to using the space for new housing. This issue was resolved by allowing other parts of the square to remain open and soft-surfaced and using the space for a library which adds life to the square, and whose configuration allows the sun to come into the space. This solution reinforces the general criteria of making the square an active place while providing different environments in the space.

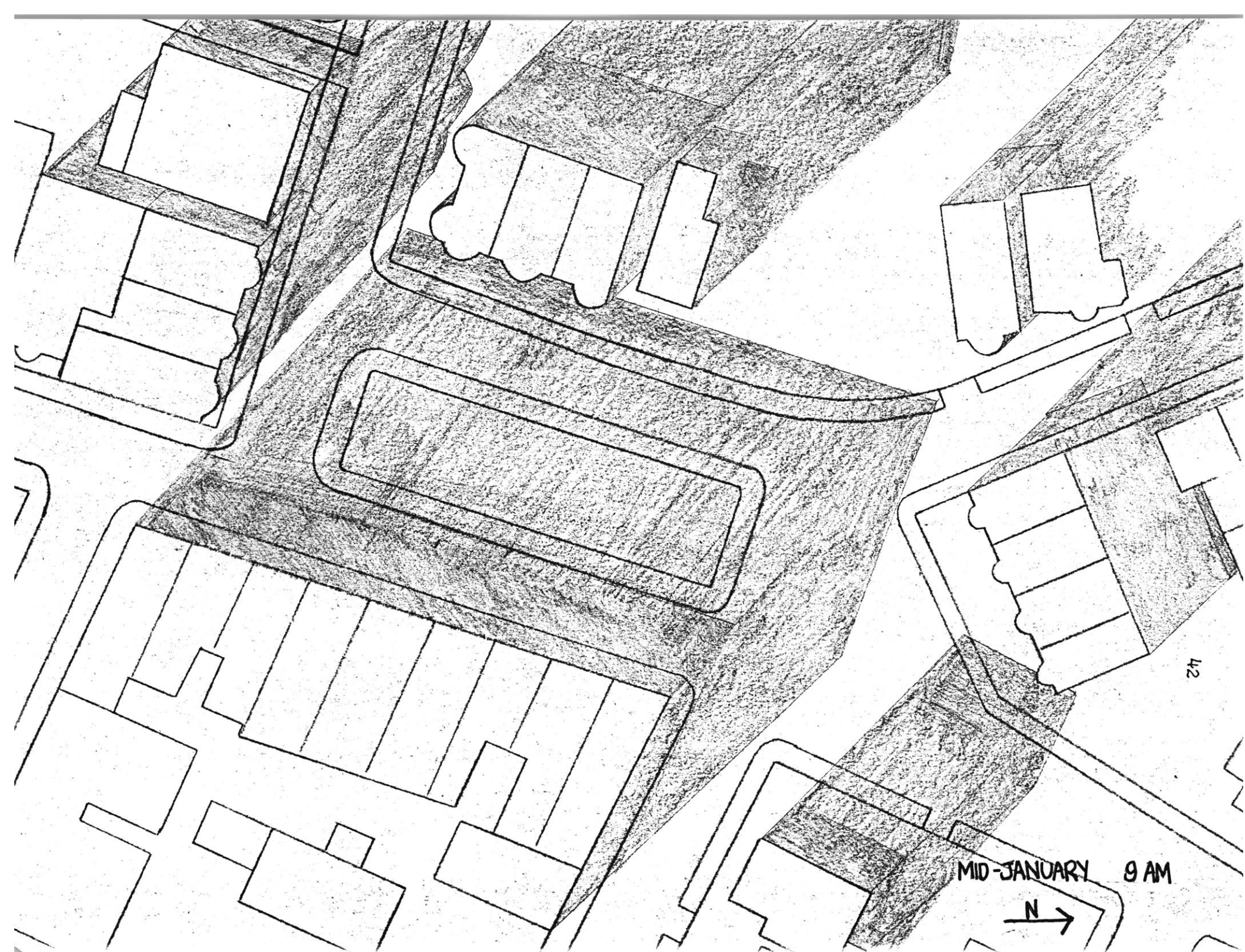
One of the programatic criteria was to provide some parking in the square. When it became clear that the open space was to be built on the value of having some sizeable green space outweighed that of including some parking and the space devoted to cars was therefore reduced. The streets have been left wide enough to allow some parking, and thus a workable compromise achieved.

As the design solutions for pieces of the square began to form it became clear that there would not be enough space to provide places for all the weather and seasonal changes to make themselves dramatically felt. However there are provisions for some of the changes to affect the space. The awning structures will support icicles and the basketball court can be flooded for an ice rink in the winter. A variety of trees, ones with flowers or dramatic foliage or fruit-bearing can be planted. Snow can build up in the depressed green area, and a fountain could be installed to play in warm weather. The awnings provide a place to sit and watch the rain, and will reflect the chang-

ing sun. In short, within the confines of a small urban space it is possible to allow a variable and interesting microclimate.

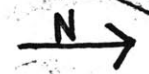
Perhaps the most exciting thing about working with a combination of physical and social design criteria has been their compatibility. There were few conflicts and where they existed solutions were possible. Finding this compatibility is important because it encourages one to believe that it is possible to design urban spaces which are amenable to both programatic and microclimate criteria, and thus which can provide usable and comfortable environments for people in the city.

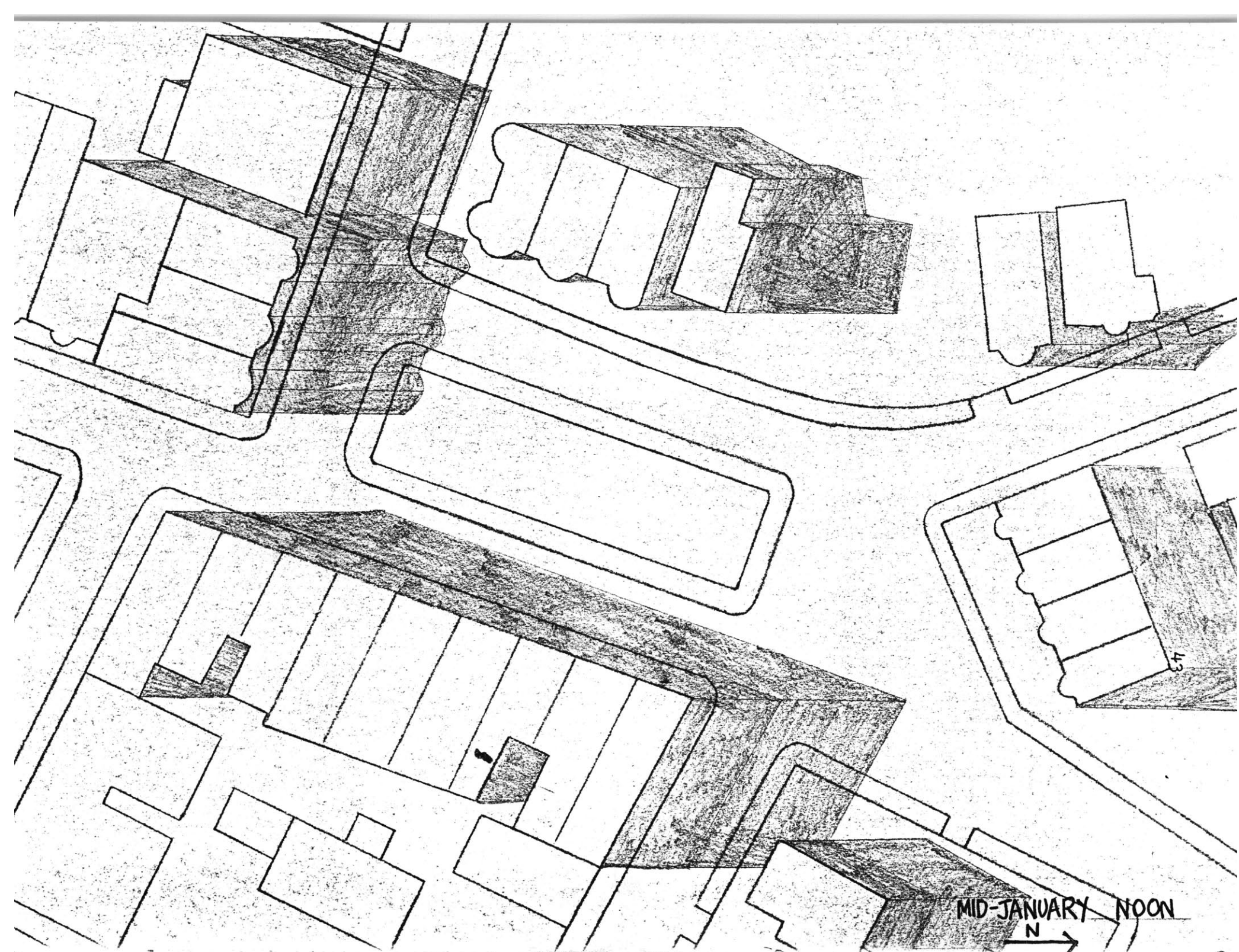
APPENDIX



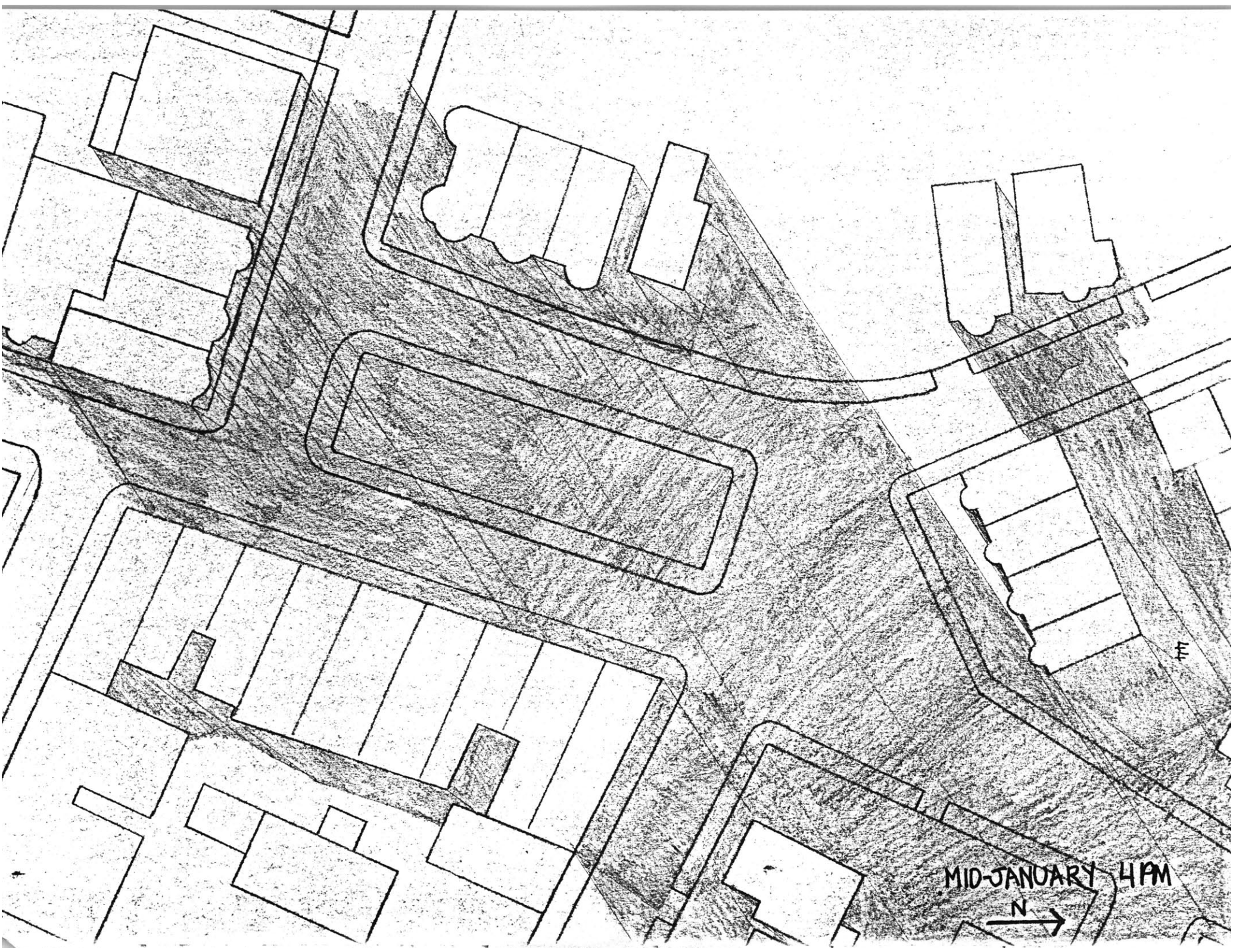
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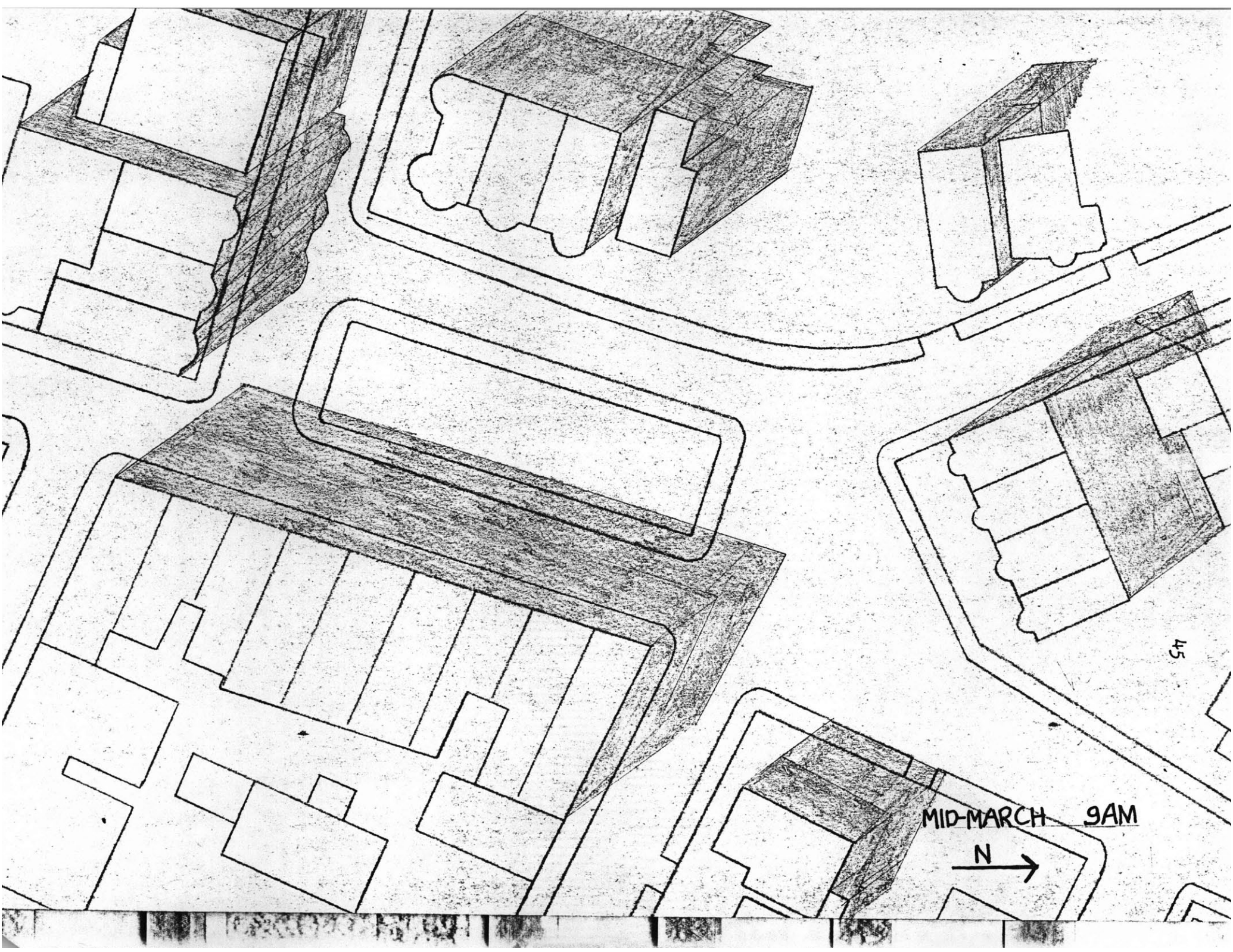




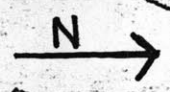
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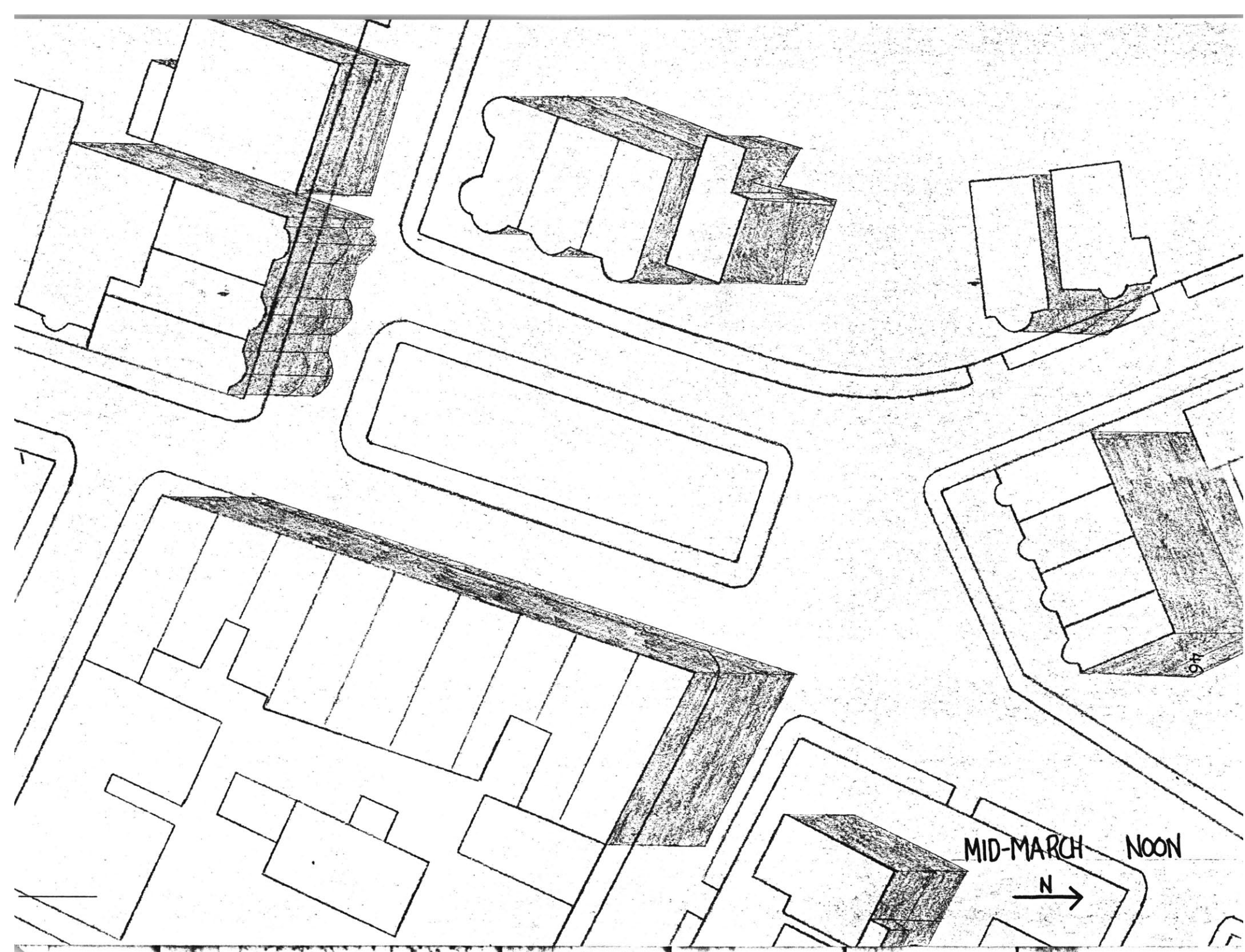
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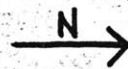


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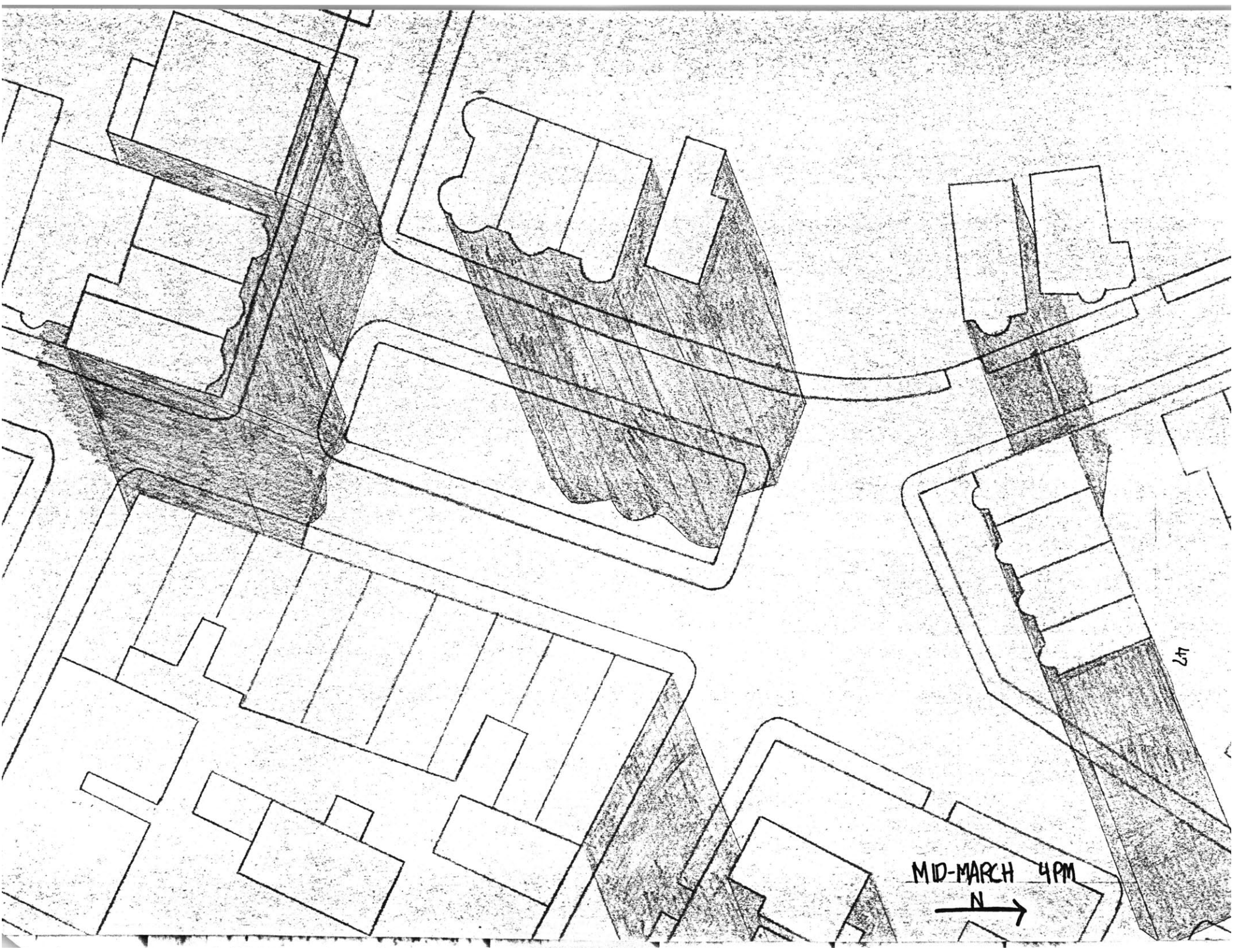


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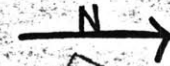
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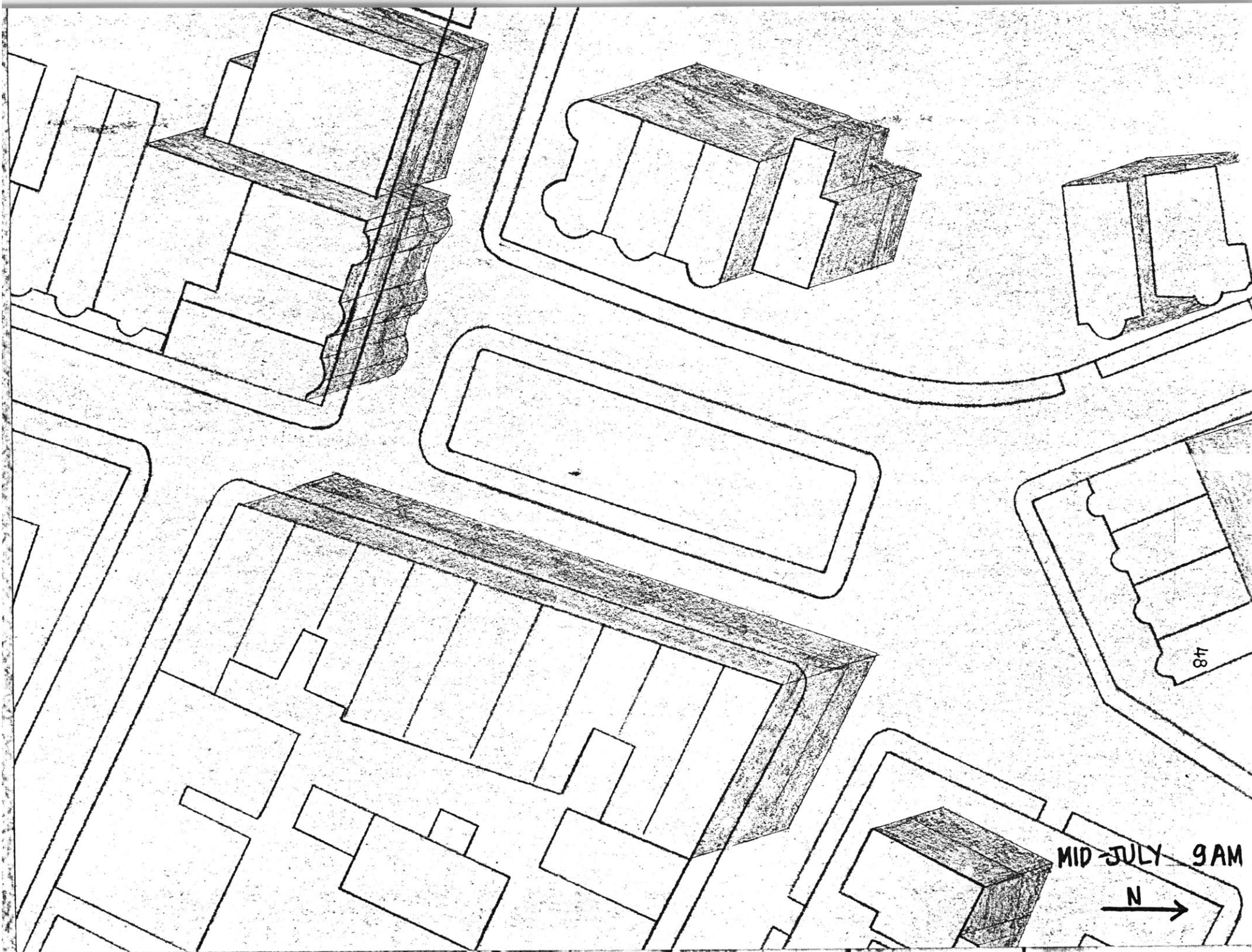


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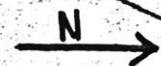


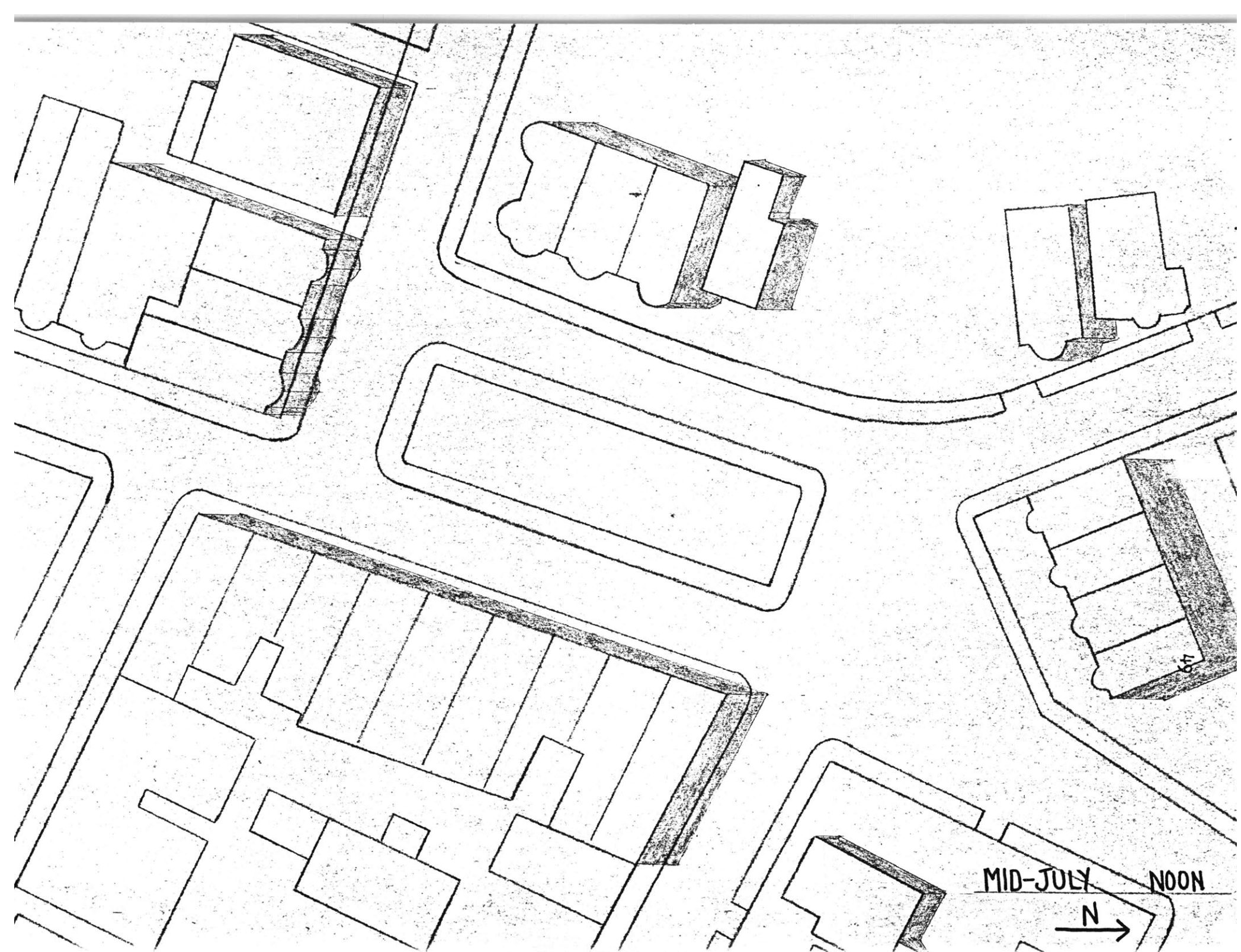
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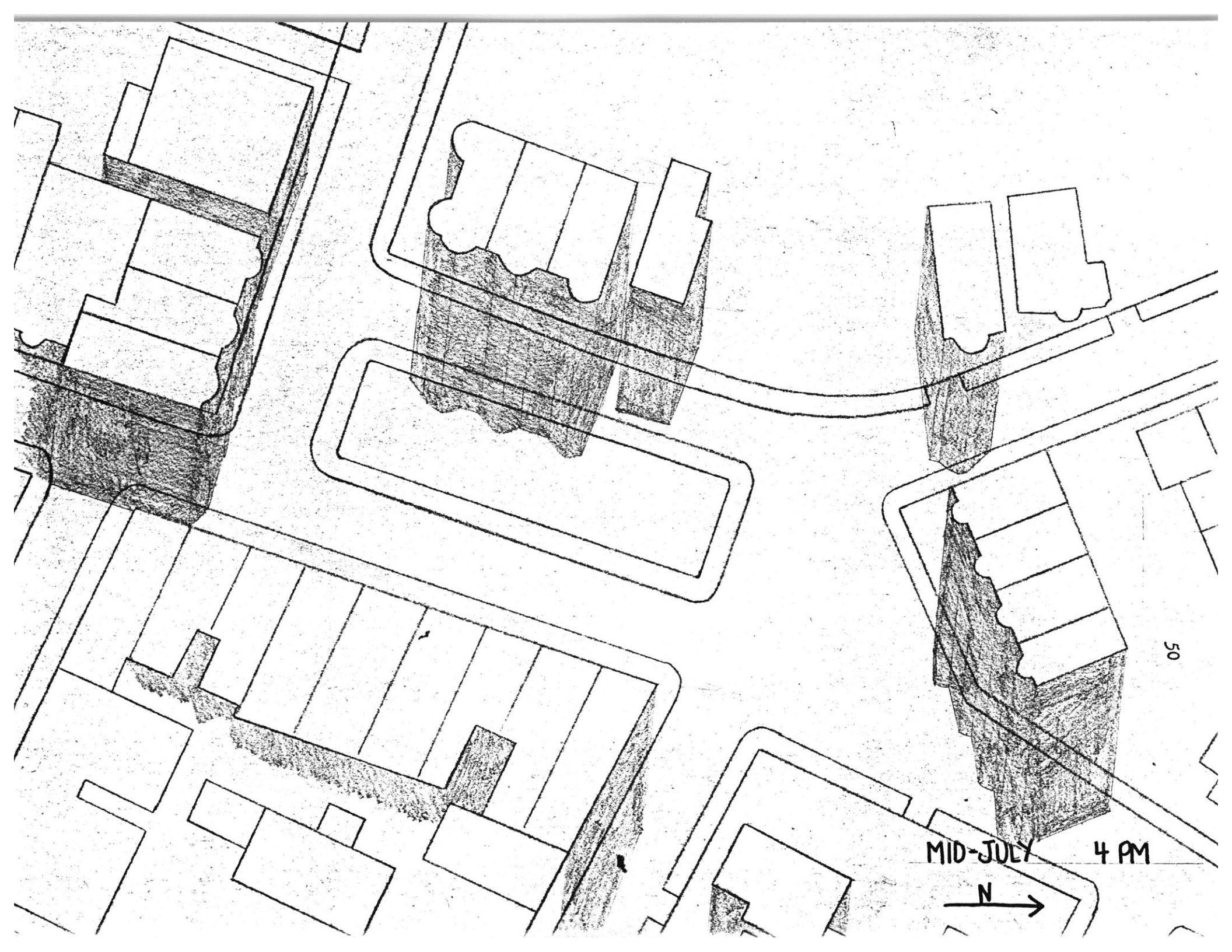




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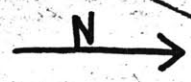






MID-JULY

4 PM



50

SURFACE TEMPERATURES
March 29 1:30 - 2:15 PM
CLOUDY BUT
WAS SUNNY EARLIER IN
THE DAY

51

42.50 • telephone pole
45.50

.540

metal railing
45.50

.530

sidewalk
440

460
brick
building

620
PULL

440
stone wall

THERMAL PROPERTIES OF SOME COMMON MATERIALS

Material	Conductivity (BTU/hr/sq.ft.) (in °F)	Specific Heat
air	0.05 - 0.06	The specific heat of a material allows the user to calculate how fast a certain volume of a material will heat up (with a specified heat input). Unfortunately this information does not seem to exist for building materials.
expanded polyurethane	0.16	
softwood	.80	
concrete block (3 oval core, 8")	.90	
hardwood	1.10	
common brick	3 - 6	
cement mortar	5	
limestone	4 - 9	
concrete	6 - 9	
face brick	9	
sandstone	8 - 16	
marble	14 - 20	
granite	13 - 28	
iron	apr. 513	

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